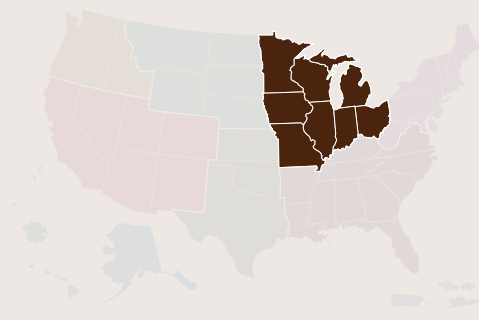


Preparing for the Health Impacts of Climate Change in **Midwest**



Temperature-Related Death and Illness

Increased daytime and nighttime temperatures are associated with heat-related diseases and death in the Midwest. High rates of heat-related illness also have been observed in rural populations, where occupational exposure to heat and access to care is a concern. A July 2012 extreme heat event in Wisconsin was associated with approximately \$290.3 million (in 2022 dollars) in damages due to loss of life, hospitalizations, lost wages, and other health-related costs.

Compared to other regions where worsening heat is also expected to occur, the Midwest is projected to have the largest increase in extreme temperature-related premature deaths under the very high emissions scenario. Climate mitigation strategies would have a great benefit to Midwesterners, as approximately 1,200 deaths related to extreme heat would be avoided by the end of the century under an intermediate emissions scenario compared to a very high emissions scenario. Northern Midwestern communities and populations disproportionately at risk that historically have not experienced high temperatures may be at risk for heat-related disease and death. The risk of death from extremely cold temperatures will decrease under most climate projection scenarios.



Air Quality Impacts

Increases in ground-level ozone and particulate matter are associated with the prevalence of various lung and cardiovascular diseases, which can lead to missed school days, hospitalization, and premature death. Ground-level ozone concentrations are projected to increase across most of the Midwest, resulting in an additional 200 to 550 premature deaths per year by 2050, some of the highest in the United States. Simultaneously, rising temperatures are leading to increased pollen counts, which can worsen allergies and trigger asthma attacks in those who are sensitive, particularly in children. By 2050, increased oak pollen is projected to lead to a 7% annual increase in asthma-related emergency room visits for the Midwest under a very high emissions scenario. Other threats to respiratory health include flooding and wildfires. Flooded buildings can experience mold growth, which can trigger asthma attacks and allergies during cleanup efforts. Further, many Midwest counties will experience increased exposure to wildfire smoke, a known asthma trigger.

Non-Hispanic Black, Hispanic, and Indigenous populations tend to be disproportionately exposed to air pollution and have the highest rates of asthma and asthma-related deaths and hospitalizations in the United States.



Extreme Events

The Ohio River, upper Mississippi River, and lower Missouri River are susceptible to floods and droughts based on projected changes in precipitation, evapotranspiration, and soil moisture. Already, there has been increased flooding in these rivers and their tributaries, which flood surface streets and low-lying areas, resulting in drinking water contamination, evacuations, damage to buildings, injury, and death. Additionally, projected increases in extreme precipitation events have been linked to an increased risk of traffic crashes.

Midwest droughts develop in response to precipitation deficits or extremely high temperatures and evapotranspiration. Groundwater recharge is projected to be variable in the Midwest, with water imbalances resulting from precipitation and evapotranspiration changes. Failure of private wells is expected to increase during droughts as water tables drop with increased irrigation and water usage.



Vector-Borne Diseases

Rising temperatures, particularly in winter, and increasing precipitation contribute to the geographic spread of disease-carrying vectors (e.g., ticks and mosquitoes) into and across the Midwest. Climate-related changes in habitats for disease-carrying insects are associated with higher rates of infection in humans and increased healthcare costs. Warmer temperatures are linked to increased numbers of deer ticks (*Ixodes scapularis*) in the upper Midwest, leading to earlier and longer seasonal exposure to Lyme disease. Further, northern expansion of the *Culex* species of mosquito (*C. pipiens* and *C. tarsalis*) in the Midwest is expected to result in upwards of 450 additional West Nile virus cases above the 1995 baseline by 2090.



Water-Related Illness

Extreme precipitation events cause dramatic shifts in water quality that can challenge the resilience of drinking water treatment systems. Likewise, large intrusions of precipitation and runoff can overwhelm wastewater treatment systems resulting in release of untreated wastewater into natural bodies of water. These events can allow contaminants to increase in groundwater and surface water sources (i.e., untreated groundwater in private wells, the Mississippi River, and the Great Lakes) eventually impacting drinking water



quality. By midcentury, precipitation changes are projected to increase the rate of gastrointestinal illness among children due to contaminated drinking water.

Simultaneously, increasing precipitation may intensify nutrient loads in the Mississippi River system, potentially contributing to harmful algal blooms (HABs). Contact with and consumption of water contaminated with cyanobacteria from HABs has been associated with skin and eye irritation, respiratory illness, gastrointestinal illness, and liver and kidney damage. However, research has been inconsistent about whether HAB severity and magnitude in the Midwest have been increasing, remaining constant, or decreasing.



Food Safety, Nutrition and Distribution

Increasing temperatures and oscillations between extreme droughts and floods threaten field crops, specialty crops, and animal production across the Midwest, which have direct and inequitable impacts on global food supply and security. Temperature increases directly affect crop development, plant physiology, and crop stress during dry conditions, and intense precipitation increases soil erosion and leaches nitrogen fertilizer, thereby affecting water quality. Animal production in the Midwest is also vulnerable to climate change. Livestock impacts include feed shortages, loss of shade structures, nutritional restrictions, disease transmission, and biosecurity concerns. Further, heat stress limits livestock production and impacts dairy quality, while increased precipitation creates muddier paddocks and pastures, which can decrease fetal growth during late gestation.

Evidence suggests that pest distributions have shifted northward since the early 20th century, and projections indicate

that increasing temperatures will allow pests (e.g., brown marmorated stink bug, corn earworm, Japanese beetle, Mexican bean beetle, and potato leafhopper) to continue expanding northward across the Midwest.



Mental Health and Well-Being

Stress associated with experiencing climate-related disasters is impacting the mental health of people living in the Midwest and is expected to increase as the frequency of extreme events rises. The trauma caused by a disaster, such as losing one's home, livelihood, or community, can contribute to chronic depression, anxiety, and post-traumatic stress disorder. In addition, people may suffer a loss of social connections, witness traumatic events, see homes destroyed, and confront an uncertain future, any of which can trigger or intensify adverse mental health conditions. Farmers and others dependent on agriculture for their livelihood are particularly at risk. Many rural Midwesterners already experience obstacles to utilizing healthcare services, including mental health services.



Populations of Concern

Tribes in the Midwest have been among the first to feel the effects of climate change as it impacts their culture, sovereignty, health, economies, and ways of life. Simultaneously, an individual's exposure and sensitivity to climate change is influenced by preexisting health conditions, age, sex, race or ethnicity, income, social connectivity, access to resources, and local adaptive capacity. For those who are chronically ill or reliant on electronic medical devices, the increased cost of electricity, which contributes to energy insecurity, may introduce financial and health burdens.

CDC Success Stories

Marquette County Health Department, Michigan

In addition to collaborating with the CDC-funded Michigan Climate and Health Adaptation Program (MICHAP), Marquette County also received a mini-grant from the CDC and the National Association of County and City Health Officials (NACCHO) in 2019 to support local adaptation efforts. The Marquette County Health Department developed a "Public Health Response to Flooding Disasters" plan to protect their community from increasing extreme rain events. This plan is intended to be a step-by-step guide regarding activities conducted by MCHD staff during a flood event. Additionally, local decision-makers are using the resource to assess climate impacts on their communities' health and using built environment design concepts to incorporate health adaptations into community planning.

Minnesota Department of Health

Extreme rainfall can wash contaminants into drinking water resources. This is particularly concerning for Minnesota as one in five Minnesotans use private wells and must maintain water quality themselves. Through multi-agency collaboration, MDPH was able to convey the climate risks to the water quality of private wells so to improve and enhance private well water testing. This was the first time climate knowledge was institutionalized into drinking water programs in the state, and it established new and continuing collaborations. Simultaneously, growing wildfire frequency means more exposure to smoke and other air pollutants. The Minnesota Climate and Health Program engaged in an interagency initiative to launch a new air quality forecast and alert program to ensure consistent messaging and that information reaches those most at-risk and key stakeholders. They also established an ongoing multi-agency relationship to develop climate-related health messaging to protect health and engage new audiences and those sensitive to poor air quality. This work has not only been supported by the CDC's Climate-Ready States and

Cities Initiative (CRSCI) but also through a 2019 mini-grant via the National Environmental Health Association (NEHA).

Michigan Department of Health and Human Services

An important climate driver of negative health outcomes in Michigan is extreme precipitation. Extreme rainfall overwhelms sewer systems, impacts drinking water, and causes power outages. The Michigan Climate and Health Adaptation Program (MICHAP) identified risks in rural and urban communities and integrated climate adaptations into community planning. By preparing the built environment now, Michigan residents will be better equipped to face their changing environment in the future.

University of Illinois at Chicago School of Public Health and Illinois Department of Public Health

Illinois experiences increased heat-related illnesses, infectious disease risk related to flooding, and mental health challenges. Despite these clear emerging health challenges, there are gaps in climate and health literacy among health professionals. To help close this knowledge gap, BRACE-Illinois developed climate and health educational materials for physicians and public health professionals. These included a heat toolkit, webinars targeted to family physicians and pediatricians, and graduate courses for public health students. As a result, Illinois has better informed medical and public health professionals who are better prepared for the health impacts of climate change and to discuss risks with their patients.

Wisconsin Division of Public Health

The Wisconsin Climate and Health Program addresses the health effects related to extreme heat, extreme cold, flooding, and vector-borne diseases. One of the adaptation activities that the Wisconsin Heat Health Network is developing is an early warning system in the urban southeastern part of the state and providing heat-health messaging to reduce the health impacts of heat-related illness. The heat health warning system will increase community climate resilience by allowing local decision-makers to implement informed interventions.

Additionally, Wisconsin developed the Flood Resilience Scorecard (FRS) to help local officials identify critical infrastructure risks and social vulnerabilities to improve flood-related health outcomes. This scorecard is a comprehensive checklist that assesses social, institutional, and environmental variables so that local municipalities can better assess their risks of flooding events. It also allows local municipalities to better plan for future flooding events by using the tool's recommendations based on their individual scores. Already, sixteen communities have completed scorecards, considered recommendations, and brought together sectors for collaboration and implementation.

Calhoun County Health Department, Illinois

Climate-driven seasonal flooding disrupts travel, farming, and other daily activities in the community. Supported by a 2022 mini-grant from the CDC via the National Association of County and City Health Officials (NACCHO), the Calhoun County Health Department (CCHD) developed a flood model to understand the speed and scale at which floods can sweep through the area. Utilizing booklets, the flooding information was shared with community members. By raising awareness on the issue, the CCHD aims to give residents the knowledge they need to adapt to their changing environment.

Franklin County Public Health, Ohio

Local health departments often do not have the resources or staff to manage climate change adaptation or mitigation programs. Using several mini-grant funds from the CDC via the National Association of County and City Health Officials (NACCHO), Franklin County established a health educator position to focus on developing climate change adaptation and mitigation projects, community outreach, and data gathering. Additionally, Franklin County developed indicators for climate health surveillance and is analyzing their metrics with climate science experts from Byrd Polar and Climate Research Center. Ultimately, they intend to provide their county climate health data to the public on their existing website.



This fact sheet was prepared by the CDC Climate and Health Program, which empowers communities to protect public health from a changing climate. Information on the health impacts of climate change is provided by the Fifth National Climate Assessment. For more information on the CDC Climate and Health Program, visit <https://www.cdc.gov/climate-health/index.html>, and the Fifth National Climate Assessment, visit <https://nca2023.globalchange.gov/>.